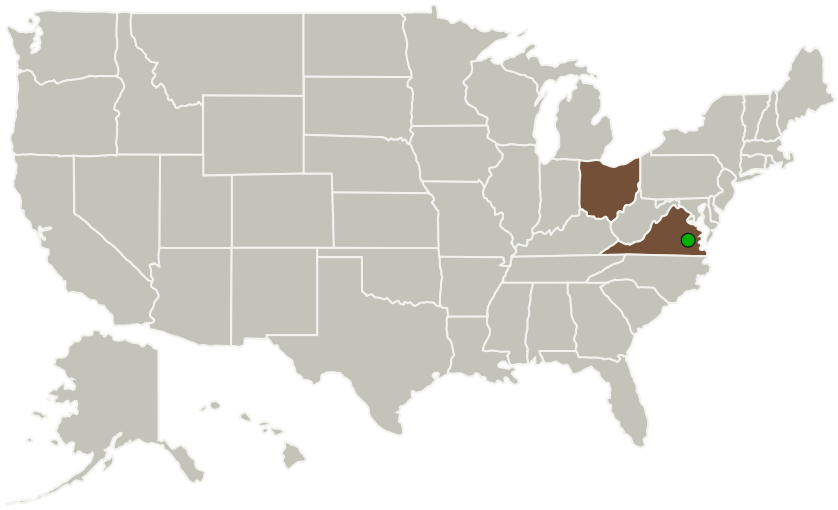
High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II

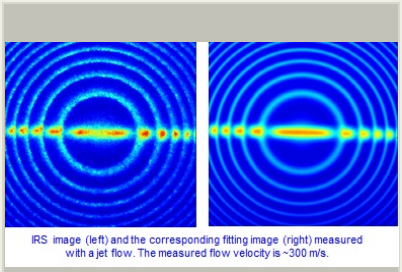
Completed Technology Project (2017 - 2020)

Project Introduction

Large ground-test facilities, which simulate real flow conditions from subsonic to hypersonic, are used extensively to generate forces and moments as well as surface measurements of test articles required to validate computational tools used to extrapolate wind tunnel data to realistic flight conditions and hardware. The development of fast instrumentation and measurement capabilities that can readily be integrated into the extreme conditions present under such test conditions is one of several major technological challenges associated with the design, building, and operation of these complex test environments. Spatially and temporally resolved measurements of velocity, density and temperature remain significant yet essential challenges in these facilities. Unfortunately, widely available current suite of flow-field probes exhibit varying degrees of intrusiveness, requiring either the physical placement of probes or seeding of foreign particles or gases. The proposed research program described here expands upon our successful Phase-I results and emphasizes the development and application of optical diagnostic approaches referred to as high-repetition-rate (up to 100 kHz) Interferometric Rayleigh scattering (IRS) and 2-D Filtered Rayleigh scattering (FRS), all-optical techniques that allow non-invasive multi-flow-parameter measurements to be made in any environments containing any kind of gases without the need to seed foreign particles or gases. The concepts and ideas proposed range from proof-of-principle demonstration of novel methodologies using 100-kHz-rate burst-mode laser system to measurements in realistic tunnel conditions expected in the current solicitation.

Primary U.S. Work Locations and Key Partners





High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II Briefing Chart Image

Table of Contents

High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II

Completed Technology Project (2017 - 2020)

Organizations Performing Work	Role	Type	Location
Spectral Energies, LLC	Lead Organization	Industry Small Disadvantaged Business (SDB)	Dayton, Ohio
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

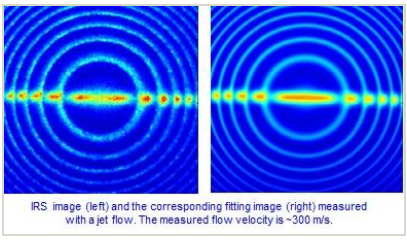
July 2017: Project Start

April 2020: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141162)*

Images



Briefing Chart Image
High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II Briefing Chart Image *(https://techport.nasa.gov/image/131400)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Spectral Energies, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

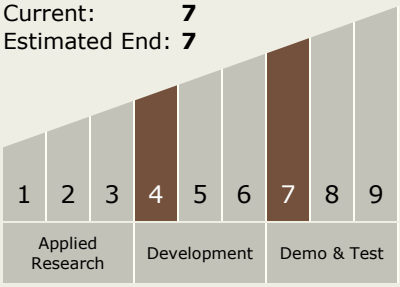
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Naibo Jiang

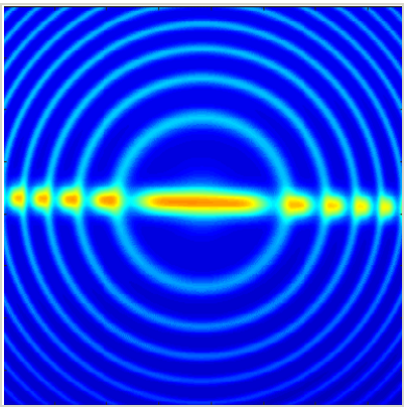
Technology Maturity (TRL)

Start: **4**
Current: **7**
Estimated End: **7**



High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II

Completed Technology Project (2017 - 2020)



Final Summary Chart Image
High-Repetition-Rate Interferometric Rayleigh Scattering for Velocity, Density, and Temperature Meas, Phase II
(https://techport.nasa.gov/image/127000)

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System